

CLAIMS

1. A method of manufacturing a silicon microphone including the steps of:
providing a first wafer including a layer of heavily doped silicon, a layer of
5 silicon and an intermediate layer of oxide between the two silicon layers and having a
first major surface on one surface of the layer of heavily doped silicon and a second
major surface on the layer of silicon,
providing a second wafer of silicon having a first major surface and a second
major surface,
10 forming a layer of oxide on at least the first major surface of the first wafer,
forming a layer of oxide on at least the first major surface of the second wafer,
etching a cavity through the oxide layer on the first major surface of the first
wafer and into the layer of heavily doped silicon,
bonding the first major surface of the first wafer to the first major surface of the
15 second wafer,
forming a metal layer on the second major surface of the second wafer,
patterning and etching acoustic holes in the metal and in the second major
surface of the second wafer,
forming at least one electrode on the heavily doped silicon of the first wafer and
20 at least one electrode on the second wafer, and
further including the step of etching the oxide layer of the first wafer from at
least the back of a diaphragm during manufacturing of the silicon microphone.
2. A method of manufacturing a silicon microphone as claimed in claim 1 further
25 including the step of thinning a portion of the second major surface of the first wafer to
form a diaphragm for the silicon microphone.
3. A method of manufacturing a silicon microphone as claimed in claim 2 wherein
the step of etching a portion of the second major surface of the first wafer is performed
30 before bonding the first major surface of the first wafer to the first major surface of the
second wafer.

4. A method of manufacturing a silicon microphone as claimed in claim 2 wherein the step of etching a portion of the second major surface of the first wafer is performed after bonding the first major surface of the first wafer to the first major surface of the second wafer.

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5. A method of manufacturing a silicon microphone as claimed in any one of claims 1 to 4 further including the step of etching corrugations in the diaphragm of the silicon microphone.

10 6. A method of manufacturing a silicon microphone as claimed in any one of claims 1 to 5 wherein the step of forming an oxide layer on at least one major surface of both wafers includes forming an oxide layer on both major surfaces of both wafers.

15 7. A method of manufacturing a silicon microphone as claimed in any one of claims 1 to 6 wherein the oxide layers formed on the major faces of the wafers are grown on the major surfaces of the wafers.

8. A method of manufacturing a silicon microphone as claimed in any one of claims 1 to 6 wherein any other suitable method is used to form the oxide layers.

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9. A method of manufacturing a silicon microphone as claimed in any one of claims 2 to 8 wherein the oxide layer formed on the second major surface of the second wafer is removed before the first wafer is thinned.

25 10. A method of manufacturing a silicon microphone as claimed in any one of claims 2 to 8 wherein the oxide layer formed on the second major surface of the first wafer is removed before the first wafer is thinned.

30 11. A method of manufacturing a silicon microphone as claimed in any one of claims 1 to 10 wherein the step of forming a layer of metal on the second major surface of the second wafer is performed by sputtering metal onto the second major surface of the second wafer.

12. A method of manufacturing a silicon microphone as claimed in any one of claims 1 to 11 further including the step of etching a portion of the second wafer from its second major surface to close to its first major surface, the portion being about the perimeter of the wafer.

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13. A method of manufacturing a silicon microphone as claimed in claim 12 wherein the etching of the perimeter portion of the second wafer is performed when the acoustic holes are etched.

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14. A method of manufacturing a silicon microphone as claimed in any one of claims 1 to 13 wherein when the first wafer is thinned at its second major surface, the first wafer is thinned to the intermediate oxide layer.

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15. A method of manufacturing a silicon microphone as claimed in any one of claims 1 to 14 wherein the step of forming electrodes on the heavily doped silicon layer of the first wafer and on the second wafer is performed by forming a metal electrode layer over the entire exposed surface of the heavily doped silicon layer of the first wafer and the exposed surface of the first major surface of the second wafer.

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16. A method of manufacturing a silicon microphone as claimed in claim 15 wherein the metal electrode layer is etched to form the electrodes.

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17. A method of manufacturing a silicon microphone as claimed in any one of claims 1 to 14 wherein the step of forming electrodes on the heavily doped silicon layer of the first wafer and on the second wafer is performed by sputtering metal and using a shadow mask to pattern the electrodes.

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18. A method of manufacturing a silicon microphone as claimed in any one of claims 1 to 17 wherein the layer of metal formed on the second major surface of the second wafer is an alloy or mixture of chromium and gold.

19. A method of manufacturing a silicon microphone as claimed in any one of claims 1 to 18 wherein any suitable conductive metal is used for the electrode.

5 20. A method of manufacturing a silicon microphone as claimed in any one of claims 1 to 19 wherein when the acoustic holes are patterned and etched into the metal layer formed on the second major surface of the second wafer, anchors are patterned and formed at the edges of the wafer in the metal layer formed on the second major surface of the second wafer.

10 21. A method of manufacturing a silicon microphone as claimed in claim 20 wherein one of the anchors may be used as an electrode.

15 22. A method of manufacturing a silicon microphone as claimed in claim 21 wherein the other anchors include both a portion of the second wafer and a cover portion of metal.

20 23. A method of manufacturing a silicon microphone as claimed in claim 22 wherein the cover metal portions are separated from metal surrounding the acoustic holes.

24. A method of manufacturing a silicon microphone as claimed in claim 23 wherein the separation step is performed by patterning and etching the separation when the acoustic holes are patterned and etched in the metal.

25 25. A silicon microphone formed using the method of any one of claims 1 to 24.